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CERTAIN OBSCURE RELATIONS OF DRINKING WATER TO DISEASE¹

BY H. E. ROBERTSON²

To the average individual a clear water without disagreeable odor or taste is perfectly satisfactory. This is an instinctive judgment developed by an inheritance extending back to the beginning of life. Such water through all time has satisfied his thirst and if he acquired disease by drinking it, personal and communal ignorance kept him blissfully unaware of that fact—the water still quenched thirst.

It is only comparatively recently that we have recognized the evils which may follow the contamination of drinking supplies by human sewage. Thus we have been led to the adoption of various and fairly satisfactory methods for the prevention and cure of these and related defects in our urban water systems. In short we have materially advanced beyond our remote ancestors' conceptions of what constituted proper drinking water. We recognize and endeavor to side step the menace of invisible human excrement. This achievement is no mean triumph. Aided and abetted by the bacteriologists and the epidemiologists, sanitary engineers have made practical and trustworthy our defenses against water-borne parasitic diseases.

The ordinary citizen receives, however, all this regulation of his drinking water, with only the theoretical approval of his intelligence. His real standards still remain on the old plane established by the instinctive reactions of untold generations. The rationality of these instincts and their inherent contribution to the survival of the human species must be freely granted. Our primeval forebears ate their food either raw or only partially cooked and they added nothing to their natural drinking water. They had little need to think of salts, extractives or vitamins. Nature's table was bountifully

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provided with these necessities and ancient customs did not interfere with their utilization.

With the development of what we are pleased to call civilization the preparation of food has become more complicated and the provision of a common protected source of drinking water a recognized measure of safety. Meats are cooked by heat and vegetables are boiled and the people's supplies of water are filtered, sedimented, often softened, and usually sterilized. By these means we have partially protected ourselves against parasitic diseases. To the average sanitarian, to say nothing of the average individual, these changes appear to represent a net gain, an advance in the protection of human life and health which constitutes an entirely plus factor.

Unfortunately the matter is not quite so simple. It is an almost universal experience that no forward step in material progress is ever made without a distinct defect to offset the greater gain and it is by the broad minded recognition and correction of these defects that real advances are justified and made secure. So it is that by the artificial improvements of natural eating and drinking supplies, definite and often serious losses have occurred and occasionally may have even counterbalanced the admitted gains of modern sanitary methods.

Extended discussion of these very complex problems would be hardly possible or fitting at the present time. Indeed the actual extent of our accurate knowledge in regard to the exact needs of the body and how best these needs may be served is exceedingly meagre. We know for example that certain mineral salts are absolutely necessary, if metabolism is to be maintained at a normal balance. Calcium, sodium and potassium salts, iron, phosphorus and iodine are some of these essential constituents. Lack of calcium causing pathologic bone and tooth formation, and insufficient chlorides with serious disturbances of the equilibrium of the blood plasma are fairly well established. Iron is necessary for hemoglobin building and phosphorus plays an important rôle in the formation of many of the lipid elements, particularly of the nervous system. Only recently it has been fairly clearly demonstrated that endemic goiter is the result of a deficient supply of iodine in the drinking water. This particular disease has long been a subject of speculation and investigation and many years ago there was collected considerable evidence which indicated that the incidence of ordinary simple goiter (not toxic goiter) in some way was con-

nected with the drinking water. By the work of Marine and his pupils this suspicion now becomes a certainty. Not only has goiter been produced in animals by giving them water deficient in iodine but also by supplying to the water small quantities of this element the goiters have been caused to disappear. In an experiment with the school children of Cleveland, of 2190 who were given a small amount of iodine at regular intervals, only 5 developed goiters, while among 2305 not given iodine, 495 showed enlargement of the thyroid. Moreover out of 1182 children already having goiters and receiving iodine 773 revealed reduction in the size of the goiter while in 1048 similar cases without iodine only 145 showed a decrease.

These remarkable demonstrations have a double significance. Not only do they show the cause and prevention and cure of simple goiters but they also indicate that under certain conditions supposedly satisfactory drinking water may actually carry a potential menace to the health of our people. Unfortunately not many other vital constituents of drinking water have been so fruitfully studied as iodine but there are sufficient evidences in existence to warrant the belief that other deficiencies may be present in certain geographic areas and may be producing equally serious results.

Still more vague must be the estimation of the influence exerted by an *excess* of these mineral elements. With that quality of water termed "hardness," the measurement of its degree and its deleterious action on steam boilers and the housewives' tea kettles we are all familiar. We even deprecate its disagreeable properties when used for washing and bathing purposes and some of us feel fairly certain that its action on the skin is sometimes distinctly harmful. So important has this subject become that elaborate and expensive measures are now used for "softening" such water. But what the effects of the prolonged drinking of such water may be has not yet been determined. Sometime ago I was struck by the frequency with which I found calcium deposits in the kidneys of people who had lived in certain districts of our country but further observations are needed to establish the significance of this observation. In short we have few accurate data which may serve to evaluate the effect of abnormal increase in our food or drink of any particular salt or element.

Even more vague is the subject of vitamins in relation to drinking water. Up to the present time these substances have been shown to have a vital relation to health and disease, but they have been

studied almost exclusively in the foods that we eat and not in the water that we drink. While we are fairly certain that distilled water is not an ideal beverage, whether its insufficiency is a poverty of salts or organic vitamins or both, has not been determined. Just as in the thorough cooking of foods to render them sterile, more palatable and more readily digestible, we find that certain important mineral constituents are lost and the vitamins often destroyed, so it may prove also true that in our intensive treatment of drinking waters for the purpose of making them *sanitary* certain undesirable *by-products* of this treatment may be causing pathologic conditions whose importance we are at present unable to estimate.

One hesitates to critically comment on procedures which have repeatedly proved their life and health saving worth. But, as I have already emphasized, it is only by a searching survey of all the effects of even the most successful measures that continued progress becomes possible. It is not, however, my purpose and neither is it within the range of my ability to review the possible deleterious actions of hypochlorites or chlorine when used to purify municipal water supplies. I merely desire to indicate, that, after having conclusively demonstrated the usefulness of these chemicals both in emergency and in routine practice, the experiment is now being conducted on a large scale, and that the time is now ripe to carefully scrutinize any suspicion of unfavorable action which these substances may be directly or indirectly exerting on the welfare of the human organisms which they serve. Once having solved the problem of combating the menace of certain water and food borne diseases, we cannot afford to disregard those more insidious, slow acting and less fulminating conditions which just as surely harm the effectiveness or bring about the disintegration of the body's vital capacities. The more obscure and perplexing the puzzles become, the more able and painstaking must be the efforts at their solution.

The outlook for continuous advances in this direction is particularly hopeful. Whenever the problems of the protection of the health of the public have involved their special fields, sanitary engineers have always responded by the elaboration of practical and efficient measures. Whenever their science or any related science has indicated the need they have ever willingly and successfully shouldered the burden.

Our faith in the future has had abundant justification in the past and we may confidently expect that once it can be definitely demonstrated that certain constituents of our communal drinking supplies are either harmfully deficient or harmfully in excess, the response by a definite remedy will surely be forthcoming. Our present demand, as in all fields of scientific endeavor, is for more certain light.